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STUDIES ON DIVERSITY AND POPULATION DYNAMICS INSECT PEST IN AGROECOSYSTEM FROM WASHIM DISTRICT M.S. INDIA

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INTRODUCTION

A population describes a group of individuals of the same species occupying a specific area at a specific time. There are some characteristics of populations such as population density, the birth rate, and the death rate. Population dynamics is the study of changing pattern of size, age, sex, composition of the population. In particular area external factor affects caused to the change in population. These are natality, mortality, immigration, and emigration, which affect the population.

Agriculture is the main occupation of the Washim and Maharashtra people. About 82% of the rural population depends on agriculture in Maharashtra. (3, https://maharashtra.pscnotes.com) Most of the crops like Soybean, Wheat, Rice, Maize, Sorghum, Fruits, Cotton, Pulses, Groundnut, Sugarcane and Vegetables are cultivated around Washim. But some specific crops are selected for research study. Washim is located in the eastern region of Vidarbha and Hingoli lies to its south. (19, https://washim.gov.in/en/about-district/) According to a recent report (FAO) the world's most agriculture crops are lost to pests. Pests in agroecosystems can be classified in a variety of ways. On the basis of morphological differences there are many types of pests, for example insect pests, birds, mammals, helminth (nematodes), weeds, and parasitic plants, microorganisms (pathogens), fungi, Mollusca, and mite pest. In the region of research study area deer, wild pig, monkey, blue cow, mouse, etc. are found but in this research, study only select insect pest diversity and population dynamics. Some orders of insect pest like Hemiptera, Odonata, Coleoptera, Orthoptera, Lepidoptera, Diptera, Hymenoptera,

Dermoptera, Homoptera are the most common found in agroecosystem. (7, J. Banu, L. Merlin Dayana 2019) Others are classified by nature, intensity, (Gyeltshen***, 2009***) according to **Smith and Basch** (1967) regular pest, occasional pest, potential pest, seasonal pest, and migrant pest. Agroecosystem pests are divided into monophagous pests, oligophagous pests, and polyphagous pests based on their nature of damage. Agroecosystem pests have originated since humans started farming. Some of the important reasons for the emergence of agroecosystem pests are deforestation and bringing under cultivation, destruction of natural enemies, intensive and extensive cultivation, introduction of new varieties and crops, improved agronomic practices, accidental introduction of pests from foreign countries, large scale storage of food grains.

Farmers have been competing with agroecosystem pests for nearly 10000 years now. Nowadays various types of new pests have been added to the agroecosystem. Crops that are part of the agroecosystem suffer massive losses or damage due to pests. Without crop protection, nearly 70% of crops are destroyed by pests. A 30% yield loss is caused by weeds and animals, and a 17% loss by pathogens. (20, https://www.agrivi.com/) This is according to the Food and Agriculture Organization (FAO). 20% - 40% of yields are lost due to insect pests in the world. (21, https://www.fao.org/home/en/) Agroecosystem losses vary from country to country and crop to crop depends on population of Insects pest. Insect pests - 15.6% production loss. Estimated annual crop loss in India due to insect pests Rs.29,240 crores (Dhaliwal and Arora, 1996). As per recent statistical analysis of the Second Advance Estimates of production of major crops for the year 2021-22 released by the Ministry of Agriculture and Farmers Welfare, India can produce foodgrains production of 316.06 million tones is estimated. (22, https://pib.gov.in) About 30-35% of India's annual crop yield gets lost because of pests, according to P.K. Chakrabarty, assistant director general (plant protection and biosafety) of the Indian Council of Agricultural Research. (**18, The Hindu (25.02.2017)**)

Several methods are used to monitor pests, such as pheromone traps, light traps, colored sticky traps, pitfall traps, and suction traps. (**10, M. Sean Clark *et al.* (2009)**) The monitoring of agroecosystem pests is crucial for identification and management of these pests. Taking representative samples is an essential step in monitoring crop pests and diseases. Field sampling methods should be simple, rapid, and reliable. Sampling methods may not be chosen without prior consideration of the distribution and behavior of the pest or pathogen at the time of sampling. Monitoring pests or parasite attacks on crops is limited (with some exceptions) to the practical means available to many farm advisers. But reference will also be made to regional or country-wide monitoring schemes developed more recently using electronic equipment for pest monitoring. Pest monitoring is done using pest management software for pest monitoring in foreign countries. For example, AGRIVI is farm management software to manage pests, pathogens, and weeds on your farm. (20**,** https://www.agrivi.com) Recently, modern technologies are useful for field surveys of several pests, such as radar technologies monitoring pest migration, video equipment like drones to observe flying insects, Global Navigation Satellite System (GNSS). (**1, Barkat Hussain *et al***.) This research study will help the farmer by providing details information for identification, prediction, and protection of various types of agroecosystem insects pests.

This results in providing information about diversity and population of insect pest for management or control of insect pest in agroecosystem. This is why we selected the topic of diversity and population dynamics insect pest in agroecosystem as our research topic.

REVIEWEW OF LITERATURE:

Pena (2002) it's related with integrated pest management and monitoring technique for mango pests. Outcome of this study is implementing an integrated pest management program for mango pests. Results of the study is control and management of mango pests by using sampling and monitoring methods. **(8)**

Shetty *et al*. (2010) to study the influence of farmer's awareness, education and practices related to pesticide use as well as Integrated Pest Management (IPM) measures. the region of 28 districts in 12 Indian states. Outcome of this study is to reduce the dependence on pesticide it is important to promote both Integrated Pest Management practices and other non-chemical methods in these regions. Results of this study is to educate farmers about pesticides**. (17)**

Prabhakar Mathyam (2012) this study is about pest monitoring and forecasting in the region of India. Outcome of this study is pests are monitored through a variety of monitoring tools such as pheromone traps, light traps, colored sticky traps, pitfall traps and suction traps. Results of the study is identification, management and forecasting integrated pests. (14)

McCravy (2018) study of the "A Review of Sampling and Monitoring Methods for Beneficial Arthropods in Agroecosystems". The outcome of the study is providing benefits of worth billions of dollars annually by pollination and pest control. The results of the study are controlling Insects pests by using sampling and monitoring methods. **(11)**

Syed Talib Hussain *et al*. (2018) this study or project were conducted from 2012-2014 to develop the georeferenced maps on Cole crops for observing foliage damage index (FDI) and hot spots for cabbage butterfly in the district of Kashmir Valley. Outcome of the experiment is monitoring of Pieris brassicae by using GIS-GPS technology. The result of the study is georeferenced maps can be utilized to assess foliage damage in future by using satellite images and could play

an important role in developing pest management strategies for cabbage butterfly. **(15)**

Scaccini *et al*. (2020) this study is slug monitoring and impacts on the ground beetle community in the frame of sustainable pest control in conventional and conservation Agroecosystems. The present study outcomes is to focuses on the evaluation of slug and ground beetle monitoring strategies in conservation agriculture**. (16)**

Emily Bick (2020) A Novel CO2-based insect sampling device and associated field method evaluated in a strawberry agroecosystem in region of America. Outcome of this study is accurate insect sampling methods to inform integrated pest management strategies. Results of the study is carbon dioxide application proves an effective means of anesthetization compared to negative controls, and an increase in net CO2 exposure results in a decrease in time until L. Hesperus anesthetization**. (2)**

Matheus Cardim Ferreira Lima *et al*. (2020) this study about automatic detection and monitoring of insect pests. These techniques outcomes are early detection and monitoring of aggressive and quarantine pests. The result of this study is the identification and monitoring of insect pests using automatic traps brings a novel approach to the integrated pest management**. (12)**

Lee *et al*. (2022) this study about predator-pest dynamics of arthropods residing in Louisiana soybean agroecosystems. Outcome of this study is the utilization of natural enemies as a control tactic is a fundamental part of any pest management plan in Louisiana soybeans. In this study, predator-pest dynamics of arthropod communities in Louisiana soybean were addressed and control by biological methods**. (9)**

OBJECTIVES:

There are different methods used to estimate or collect information about diversity of insect pest. The objectives of the research study are to detect the presence or absence of pests in the agroecosystem. Major objective of research is pest detection and forecasting, as well as checking your field, landscape and agricultural areas to identify which pests are present, how many there are, or what damage they've caused by using some support systems.

1. To conduct research on structural changes and new pest outbreaks in the agroecosystem.
2. To study specified insect pests at the micro and macro levels in the agroecosystem.
3. To study how the seasonal fluctuations in the diversity and population of insect pests.
4. To study of the population growth and analysis and interpretation of data related to insect pests.
5. To provide technical advice to farmers about insect pests that hurt the agroecosystem.
6. To improve farmer profitability and income by providing the right information at the right time and innovative solutions.
7. The ultimate goal of this study is to protect crops from agricultural pests.

HYPOTHESIS:

This research study will be useful for identification of specific insect pest species in the research area. Methods for sampling and surveying in the field should be easy, suitable for studies of diversity and population of insect pest. This study will be useful for the evaluation of samples for correct assessment of pest distribution and frequency of pest population. Some regional farmers are unaware about proper pest control management so, this study will provide basics information and techniques for outbreak of agroecosystem insect pests. Nowadays, new technology will make it easier to study the diversity of insect pests in agroecosystems.

The majority of farmers in this research area used pesticides, insecticides for controlling agroecosystem pests. It is results to reduced population of insect pest. The incidences of pesticide poisoning and suicides are very high in India due to poverty and personal issues. In India, most of the population is dependent on traditional agricultural methods, therefore the country is the second largest producer of pesticides in Asia and ranks fourth position in the world for the use of pesticides. WHO has reported around 3 million cases of pesticide poisoning with more than 2,50,000 deaths every year world over. So, this study will guide farmers to avoid the use of these. Due to the fact that some pesticides are highly toxic to humans, animals, other organisms, and the agroecosystem, as well as the environment, only small amounts of these chemicals may cause significant harm. Some studies show pesticides are linked to cancer, Alzheimer's Disease, ADHD, and even birth defects.

This study is also helpful for society and nation because most of the people are belong to farmers family in research area and India so, farmers know about specified insect pest diversity and population causing huge damage in their field or agroecosystem.

MATERIALS AND METHODS:

Regarding research study topic material and methods mentioned in the following.

1. Study Area:

The research study area are three tahsils of Washim district (Washim, Risod, Malegaon) located in Maharashtra, India. Washim district is located in the western region of Vidarbha (20.1390° N, 77.1025° E). Akola lies to its north, Amravati lies to its north-east, Hingoli lies to its south, Buldhana lies to its west, Yavatmal lies to its east. The Washim district divided into six tahsil Washim, Risod, Mangrulpir, Manora, Malegaon, Karanja. River Penganga is the main river of the Washim district.

It flows through the Tehsil of Risod. Later it flows through the boundary of Washim and Hingoli districts. (4, https://en.wikipedia.org/wiki/Washim_district)

2. Photography:

Camera, Smart phone, Laptop etc.

3. Binocular and magnifying glass for observation and Reference books on insect pest for identification.

4. Quadrat method:

Population density measures to count the all individuals by a simple method called quadrat method. All the individuals of insect pest species are counted by subplot of the total area.

5. Sampling and Monitoring Methods:

The purpose of sampling and monitoring technique are providing accurate identification of agroecosystem insect pests diversity and population.

A) Sampling Methods:

Different types of methods and devices used for sampling methods. Main sampling is generally divided into two techniques used to collect insects- active collecting and passive collecting. Active collecting is based on the collection of insects, such as "beat sampling", "sweep netting", and hand collecting are used for sample collection. (24 https://www.studysmarter.co.uk) Trapping, such as pitfall traps, bowl traps, blue vane traps, trap-nests, and pheromone traps, is passive collection. Some others are used depending on the type of pest that is present. Like targeted netting, malaise traps, targeted netting, direct counts on vegetation, shaking/beating vegetation, suction samplers, emergence traps, soil flooding, microhabitat removal and extraction, cryptozoan boards, sticky traps estimate of parasitism, estimates of predation etc. (11**, McCray (2018)**) Sampling methods is useful for collecting large numbers of dead pests, which can harm threatened species.

B) Monitoring Methods:

Pests are monitored through a variety of monitoring tools such as pheromone traps, light traps, colored sticky traps. These are the most popular and widely used automatic monitoring methods. It is useful for controlling insects and pests. These are existing systems that have traditionally been used with high priority. With advances in technology, research, and public concern, developed a computerized system for monitoring agroecosystem pests. This type of monitoring method was applied in Kashmir Valley for mapping of foliage damage index by P. brassicae on Cole crops from the sampling sites. This was done utilizing global positioning system **(GPS)** and geographic information system **(GIS)** technologies. (**1, Barkat Hussain *et al.***)

Automatic Detection and Monitoring of Insect Pests (Ferreira **Lima, *et al*. 2020**) - monitoring methods had been developed. In this method, an electronic machine-like sensor senses these pests and send a message to a mobile or

computer system. This is an innovative technology invented in foreign countries. I will try to use this technique for the monitoring of agroecosystem pests in the research study area.

IMPORTANCE:

A) International Status:

The present research is concerned with studies on diversity and population dynamics insect pest in agroecosystem, which are hostile or enemies of farmers around the world. Worldwide, 20-40 percent of crop yield is lost to diseases and pests. Without crop protection, these losses could double. According to the Food and Agriculture Organization, crops lost cost the global economy over $220 billion, and invasive insects at least $70 billion. (AFO **United Nations)** Therefore, it's important to take prevention and control measures. This study will help outbreak of new pest species, prediction and early detection of agroecosystem pests. It will help avoid this global economic loss with new collected data.

B) National Status:

India is primarily an agricultural country, which means most people depend on agricultural and their products. Agricultural production is one of the most important sectors of the Indian economy. In India, the GDP obtained from agriculture averaged 4532.49 INR Billion from 2011 until 2023. (India GDP From Agriculture - 2023) Pest are indirectly affecting the annual income or economy of the nation. According to previous studies, new exotic pests have entered our agroecosystem. Most farmers use pesticides to control this type of pest. We know pesticides harm our health and the environment. Exotic or national pests adapt to the pesticidal environment or poison and they form new varieties, which is not easily managed by old pest control management methods. There was a huge loss of quality and quantity of crops as a result of these pests in the agroecosystem. Reducing highly toxic pesticide use and using innovative technology for early detection and informative data about diversity and population dynamics of insect pests.

C) Regional Status:

Regional area peoples are mostly depended on the basic occupation is known as the farming. Most farmers are not well educated, so they do not have scientific information about pest diversity and population dynamics. They are using traditional pest management methods, but they are ineffective in the present situation. Farmers require more advanced technologies for maintaining and controlling agroecosystem pests. So, this research study is useful for prediction and identification of agroecosystem pests.

The goal is to manipulate pest organisms to decrease pest damage. This research study will improve management decisions by providing information on pest population levels. Farmers will be able to make appropriate pest control decisions with the help of this information. In order to study the pest population without studying the entire population, sampling is the most efficient method. A variety of monitoring methods are used to collect the most appropriate data about the agricultural pests in the research area.

D) Scope of Study:

The present study will provide new innovative ideas, techniques and technology to the country and the agricultural field by giving such a informative data. Recently, in foreign countries modern technologies of monitoring started to be used in field surveys of several pests, like Global Navigation Satellite System **(GNSS),** drones to observe flying insects, **AGRIVI** is a farm management software etc. But these are not affordable to regional or most farmers. So, the present research study will provide information or idea for control management of insect pests in agroecosystems.

YEARLY WORK PLAN:

Sr. No.	Year and Proposed Work
	First Year
1.	Literature survey, collection of data and samples
2.	Selection of suitable site for study
3.	Field visits for survey and identification of pests
4.	Compilation of data and statistical analysis
5.	Submission of progress report (6+6 months)
	Second year
1.	Identification of insect pest on selected crops
2.	Seasonal occurrence and population dynamics of insect pests.
3.	Compilation of data and statistical analysis
4.	Presentation and Publication of research papers
5.	Submission of progress report (6+6 months)
	Third Year
1.	Economical importance of insects pests
2.	Insect pest management
3.	Compilation of data and final submission of progress report
4.	Presentation and Publication of research papers
5.	Presentation and submission of Pre-PhD Synopsis.
6.	Final Ph.D. Thesis submission

EXPECTED OUTCOMES:

This study will providing scientific data or information about agroecosystem pests found in research area. Collection of samples of this study also helpful for recognition of specific agroecosystem pests and their management or control measures. Most significant outcome from this study is the improve quality and quantity of the agricultural crops and their products. This study will be helpful for saving the time and physical effort to control the agroecosystem pest. Insect sampling refers to the monitoring of insect populations to determine insect biomass, the status and distribution of insect populations, and the presence and status of pest species.

Recently, developments in information and communication technology by computer-based systems have increased the speed and accuracy for monitoring agroecosystem pests which is helpful for regional farmers in the research area. Present research study will help early detection and monitoring of aggressive and quarantine insect pest. The outcome of the present research study is to reduce the loss of agroecosystem by providing right information at right time.

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